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Newfoundland and Labrador Region | **Région de Terre-Neuve et Labrador**

Living on the edge: Observations of Northwest Atlantic harp seals in 2010 and 2011

Sur la banquise : observations de phoques du Groenland de l'Atlantique Nord-Ouest en 2010 et en 2011

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ABSTRACT

The total extent of ice suitable for whelping harp seals in the Gulf of St. Lawrence and of the coast of southern Newfoundland conditions during 2010 and 2011 was at, or near, the lowest since 1969. Harp seals responded to these poor ice conditions by using unsuitable ice, moving to other areas, extending the whelping period and pupping outside of historical areas. There was no evidence to indicate that harp seals pupped on land even in areas where ice was absent. Young seals that did drift to shore had high levels of abandonment and mortality. The specific responses of whelping seals to poor ice conditions were influenced by the amount and timing of ice development in the different whelping areas. It is likely that mortality of young was high in both years, but likely greater in 2011 than 2010. An unusual mortality of adult seals occurred between December 2010 and April 2011. Although the exact cause of death could not be determined, it did not appear to be due to an outbreak of Phocine distemper or influenza.

RÉSUMÉ

Les conditions de glace pour la mise bas des phoques du Groenland dans le golfe du Saint-Laurent et au large de la côte sud de Terre-Neuve en 2010 et en 2011 ont été les moins favorables ou presque depuis 1969. Les phoques du Groenland ont donc dû utiliser des glaces peu convenables, se déplacer vers d'autres zones, prolonger la période de mise bas et donner naissance à leurs petits en dehors des zones historiques. Rien n'indique que les phoques du Groenland ont mis bas sur la terre ferme, même dans les zones dépourvues de glaces. Les jeunes phoques qui ont dérivé jusqu'à la côte ont connu des degrés élevés d'abandon et de mortalité. La quantité de glace formée dans les différentes zones de mise bas et le moment où celle-ci s'est formée ont eu une incidence sur certaines réactions des phoques aux mauvaises conditions de glace. La mortalité chez les jeunes a sans doute été élevée au cours des deux années, mais probablement plus en 2011 qu'en 2010. Une mortalité inhabituelle chez les phoques adultes a aussi été observée entre décembre 2010 et avril 2011. Même si la cause exacte de cette mortalité ne peut être déterminée, elle ne serait pas attribuable à la peste du phoque ou à la grippe.

INTRODUCTION

Harp seals require sufficient stable ice for whelping and nursing. Following weaning, young harp seals continue to rely on the ice for resting during the post weaning fast. This ice must be stable (i.e., thick enough and pans of adequate size) to survive the storms and wave action for the period between mid February when pregnant females first haul out through late April when the young have developed their full ability to swim.

In the northwest Atlantic, pupping occurs off the coast of Southern Labrador or northeast Newfoundland (the Front) and in the Gulf of St. Lawrence (Fig. 1). Approximately, 20-25 % of the pups are born in the southern Gulf, traditionally beginning on the ice to the NW of the Magdalen Islands. A variable proportion of pups are born in the northern Gulf between the Strait of Belle Isle and Anticosti Island. Historically, this group has been quite small or absent, but has accounted for up to 10 % of total pup production in recent years (Sergeant 1991, Stenson et al 2011). The remainder pup on the pack ice off between Notre Dame Bay on the island of Newfoundland and Grosewater Bay (~54°N) in Labrador. In the Gulf, harp seals begin pupping in late February with 50 % of the births occurring by March 1 while at the Front, pupping begins in early March, approximately 1 week later than the Gulf, with peak pupping around the 7 or 8th of March. Timing of pupping in the northern Gulf appears to be similar to that of the Front.

Ice conditions in the northwest Atlantic have been declining over the past four decades throughout the historic harp seal whelping area (Johnston et al 2005, Freidlaender et al. 2010; Bajzak et al. 2011). With only a few exceptions, total ice coverage has been below the long term average (1981-2011) since the mid 1990s (Canadian Ice Service). Total ice accumulation in 2009-10 and 2010-11 are the lowest since 1969, particularly for 1st year ice which is preferred by harp seals (Bajzak et al 2011). As a result there was little first year ice available during the whelping period or the post-weaning fast.

Expert reviews provided by the Intergovernmental Panel on Climate Change (IPCC) make it clear that climate change will induce temperature changes and associated adjustments in ocean circulation, ice coverage and sea level. (McCarthy et al. 2001). As such, it is possible that ice conditions will continue to decline in this area, further impacting the southern most harp seal population.

Understanding how ice breeding seals such as harp seals respond to these changing ice conditions is critical if we wish to understand the impact of climate change. We suggest that seals may respond to declining ice conditions in one, or a combination, of five possible ways. Breeding females may utilize the ice that is available, even if not preferred or suitable; seals may abandon their normal ice habitat and pup on the beaches; seals could move north within the traditional whelping area (e.g., Gulf to Front), which may have occurred in 1969 (Sergeant 1991); whelping harp seals may also give birth outside of the traditional areas; the timing of pupping may change as females seek suitable ice. In this study we describe how harp seals appear to have responded to extremely poor ice conditions during two seasons (2010-11) within the context of the five hypotheses we have outlined above.

METHODS

IDENTIFICATION OF WHELPING AREAS

Reconnaissance flights were carried out over the traditional whelping locations in the Gulf of St. Lawrence and at the Front beginning in late February (southern Gulf) and early March (Front

and northern Gulf) 2010 and 2011. Flights, made using fixed-wing aircraft (King Air) and/or helicopters, were carried out at least weekly, and often daily, until late April. DFO Science and/or Conservation and Protection personnel familiar with harp seals were present on all flights. All ice capable of supporting seals was examined and the locations of whelping harp seals were identified. Ice movements and the persistence of whelping concentrations were monitored to determine the fate of the harp seal pups. Due to the lack of first year ice within the traditional area, reconnaissance flights were extended north of Grosewater Bay to approximately 55°N to examine suitable ice that was present in this area.

Whenever possible, the proportion of seals in 5 age-specific developmental stages (thin whitecoat, fat whitecoat, grey, ragged jacket and fully moulted beater) was determine. These data were used to determine the temporal distribution of births as described by Stenson et al. (2003, 2011).

Daily ice charts, obtained from the Canadian Ice Service (http://www.ec.gc.ca/glaces-ice/) were used to identify areas where the reconnaissance flights were conducted. Trends in ice development and accumulation in the Gulf of St. Lawrence and southeast Labrador Sea from 1989/69 to the present were also obtained from the Canadian Ice Service archives.

RESULTS

2010

Gulf of St. Lawrence

The total amount of ice present in the Gulf of St. Lawrence during the winter of 2009-10 was at, or near, the lowest in the Canadian Ice Service time series (Fig. 2). The amount of 1st year ice in 2010 was lowest since 1969. Overall, there was very little new or 1st year ice and what ice was present formed during January, but disappeared (for the most part) by early February (Fig. 3). Therefore, there was no ice present by late February when female harp seals normally haul out to pup.

Very little pupping was observed in the Gulf with no whelping concentrations in the southern Gulf due to the lack of ice. Although all of the beaches were examined, there was no indication that harp seals pupped on the shore.

The only indication of pupping within the Gulf of St. Lawrence was in the in the northern Gulf and Strait of Belle Isle where seals were observed on ice. This ice was very limited, extremely loose and consisted of small pans only. The ice shifted considerably as the winds changed, at times being driven on shore along the Newfoundland coast, while at other times being pushed out into the middle of the Gulf. Adult and young seals were present on almost any piece of ice that was thick enough to support them. These pans were often degraded further, forcing the animals into the water.

A few thousand seals were found along the Newfoundland shore from the Strait of Belle Isle (Cape Norman) south to Port Saunders, The lack of blood and afterbirth indicated that the seals were not born on the beaches, but rather were born on the ice that was pushed to the shore. Most of the young were still on the ice although some had moved onto the shore itself. Mortality and abandonment was high (> 10 %) among these pups, compared to that observed on the ice in 2011, and in previous years. Twelve of these pups were collected to determine cause of death. The identified causes included starvation, trauma from crushing by ice pans, pneumonia and infections. In addition, there were also reports of coyotes taking pups from the beach.

The timing of pupping in the northern Gulf near the west coast of Newfoundland did not appear to have changed from earlier surveys with 71 % of the seals being greys and 17 % ragged jackets on March 21. This is similar to that seem in previous years (Stenson et al. 2002, 2003) although later than seen in 2008 when pupping appeared to be earlier than normal (Stenson et al. 2011). There were too few pups found in the southern Gulf to determine timing of births.

Front

Total ice accumulation in the southern Labrador Sea was well below average in 2009-10 (Fig. 4). Along the southern Labrador coast, the ice consisted primarily of loose, small pans in late February and early March (Fig. 5). Although most of the pack ice was thin, some thicker (> 30cm) ice was present along the shore, particularly in areas where it was protected by islands. By early March, the southern edge of the main ice pack typically used by harp seals was located north of Grosewater Bay which is the northern limit of the area historically used. During March and April, this band of extensive, first year ice drifted south into the Front area. As a result, ice cover in the later half of the season was closer to normal. However, the ice along the southern edge where seal pups were observed earlier in March broke up and disappeared.

Pups were observed on the loose, first year ice present along the coast of southern Labrador. The majority of the pups found in southern Labrador were near the edge the relatively stable shore fast ice found in the bays and protected by islands. A large whelping concentration (> 100,000) was located in early March off the coast near Makovikk (~55°N) which is north of the historical area where harp seals have been known to whelp (Fig. 6).

2011

Gulf

The ice in the Gulf of St. Lawrence was characterized by very low total ice and a similar absence of first year ice as seen in 2009 and 1969 (Fig. 2). There was, however, more thin (new and young) ice than seen in 2009. Most importantly, this thin ice formed in mid February and was present during the normal pupping period in late February (Fig. 7). Unfortunately, however, it quickly disappeared and very little ice persisted in the Gulf past mid March.

In the southern Gulf, harp seal pupping was observed on the ice that formed to the west of the Magdalen Islands. However, this ice quickly broke up and the pups lost. Additional pupping then occurred in the area with these pups being lost as the ice drift away and broke up. Overall, pupping appear to begin at the normal time (~February 23), but progressed slowly with 50 % of pupping not occurring until March 2 (Fig. 8). Large numbers of whitecoats were still present late in March, with few beaters being present even into early April. In early April, dead pups washed ashore in Prince Edward Island, supporting the assumption that high mortality of pups likely occurred.

Females with pups were located along the ice edge in the northern Gulf and Strait of Belle Isle in early March. These seals were resighted throughout March and were the target of hunting in early April. However, by early April, relatively few pups were present suggesting that mortality was high during March. Also, large numbers of adults without young were observed hauled out on the ice which is unusual in this area during late March and early April. Sealers hunting in the area reported that the seals did not appear to be moulting and that the seals appeared 'lethargic'.

Front

As in the Gulf, ice developed late and retreated early in 2011 (Fig. 9). Unlike previous years when ice usually reached the Strait of Belle Isle by late December, there was no pack ice along the entire Labrador coast prior to mid January. By late January, some thin ice was present along southern Labrador. Unlike 2010 when this early ice broke up, the ice persisted in 2011 with first year ice being seen in late February, However, the total amount of ice was well below average with the amount of first year ice being the lowest in the time series (1969-2011).

A large concentration of whelping harp seals and pups were located on small pans of first year ice off the coast of southern Labrador (~52 23N 53 50W) in mid March. The area and age of the pups appeared normal suggesting that pupping had occurred as in most previous years. We were unable to locate this group during flights made 10 days later. By that time, the ice had drifted southward and dispersed. Scattered young, possibly the remnants of this concentration, were seen on loose ice north of Notre Dame Bay. As in the northern Gulf, large groups consisting of non-moulting adult harps were found on the pack ice along the southern Labrador coast.

No whelping concentrations were found during reconnaissance flights north of Grosewater Bay. Also, no young were seen on the ice as it drifted southward into the area that was examined extensively during March and April. This suggests that in 2011, pupping occurred within the historical areas only.

The 2011 harp seal hunt in the northern Gulf and at the Front opened on April 11. The few animals taken (~40,000) were found in the Strait of Belle Isle or along the southern edge of the ice in Notre Dame Bay where they were seen during the reconnaissance flights. The sealers reported the odd whitecoat and that the majority of young were still moulting (i.e., ragged jackets) in mid April. It is unknown if the late occurrence of these animals is due to an extended moult or an extended period of births. A few (4-5) white coats were observed on beaches along the south coast of Newfoundland during mid and late April. This area is ice free and these animals may be the result of extraneous births among seals that would normally pup in the Gulf.

DISCUSSION

Of the five possible responses to a lack of ice, harp seals showed signs of modifying their behaviour by using whatever ice was available, as well as changing locations of pupping and extending the pupping period. However, there was no evidence to indicate that harps pupped on shore regardless of how poor the ice conditions were. There was a report of a hooded seal pupping on the beach in Prince Edward Island, but there were no observations of any significant numbers of pups anywhere other than the northern Gulf. In this area, the pups appear to have been born on ice and then carried to shore rather than being born there. The high level of abandonment and mortality we observed illustrated the dangers associated with being born outside of their normal ice habitat.

The response of harp seals to the poor ice in 2010 and 2011 differed partly because of the way in which the ice formed in the different areas and between years. In 2010, there was, at best, only a little poor ice in the southern parts of their range and we saw what appeared to be a movement of pupping from the southern gulf to more northerly areas as reported in 1969 (Sergeant 1991). We also saw harp seals use the available ice even though it was unsuitable. Some was extremely thin and could barely support their weight. Although we have data on the

locations of the Front whelping concentrations going back to the 1950, this is the first time a whelping patch was found north of Grosewater Bay. The southern edge of the ice pack that harp seals normally use (6+ tenths of ice > 30 cm) did not come south of the bay until latter in March. During January and February, many harp seals feed on the southern Labrador Shelf and northern Grand Banks (Stenson and Sjare 1997; Lacoste and Stenson 2000). During the latter half of February, they move northward to find suitable ice for pupping. It appears that in 2010, many of the seals continued to move northward out of the traditional area until they encountered the suitable ice pack. The possibility that seals may pup outside of the historical areas will affect our ability to assess this population. Future surveys will require more extensive reconnaissance to ensure that we do not miss any whelping concentrations that may occur in areas not normally examined.

Extra-limital pupping did not appear to have occurred in 2011. This is likely due to the way in which ice developed in 2011 compared to 2010. In 2010, there was little ice present at the time when seals hauled out to pup and so they were forced to move out of their traditional areas. In 2011 however, ice had formed although it was not thick or extensive enough to last until the young were able to survive in the water. Although mortality was likely high in 2010, it was likely even higher in 2011.

Preliminary examination of reproductive tracts from mature females indicate that late- term fecundity rates were very low in both 2010 and 2011 (Stenson unpublished data). The proportion of mature females that were pregnant in 2010 was only 30 %, a significant decline from the 56 % seen in 2009. In 2011, this had declined even further to only 22 %. In addition, 13 % of mature females showed signs of having given birth prematurely in 2011. Considering the low pregnancy rates, high proportion of females that gave birth prematurely and the post natal mortality, the total number of young that survived was probably extremely low.

Hood seals whelp in the same general location as harp seals (Stenson et al 2006) and although likely to be impacted by the lack of ice, it is not clear to what extent they would have the same high mortality as harp seals. Few hoods were seen during reconnaissance flights and we were not able to monitor any hooded seal whelping concentrations during either 2010 or 2011. Hoods generally use the thicker, small pans than harp seals. They have an extremely short lactation period, on average 4 days (Bowen et al.1985), which may allow them to successfully wean their pups even in years when ice breaks up early. In 2010, the total lack of ice in the southern Gulf would have resulted in either high morality or the movement of whelping females to the Front. Although hoods from the Gulf and Front cannot be distinguished genetically (Coltman et al 2007), the relationship between whelping areas in the northwest Atlantic is not clear (Stenson et al 2006) and so it is not possible to speculate if some hoods from the Gulf may have move northward. If they did not, high pup mortality may have a significant impact on this small population.

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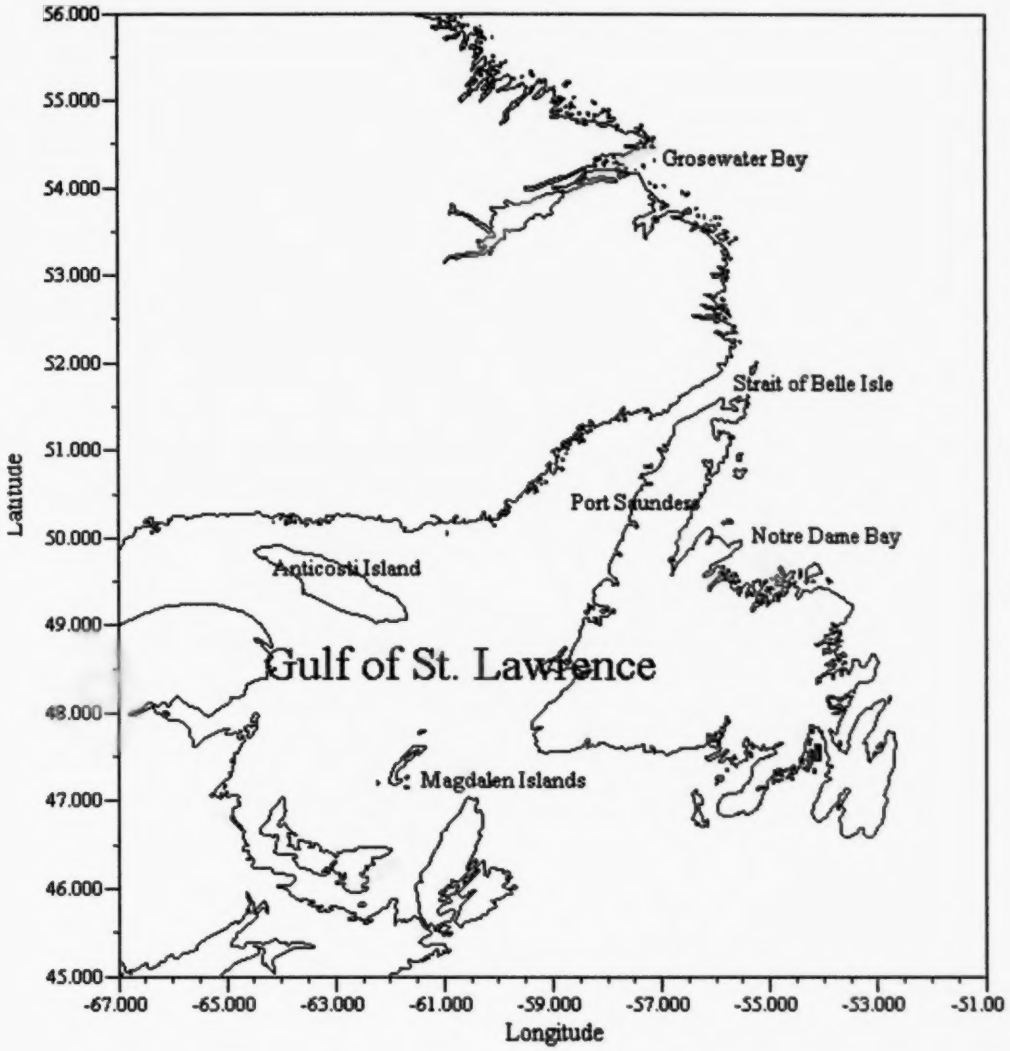
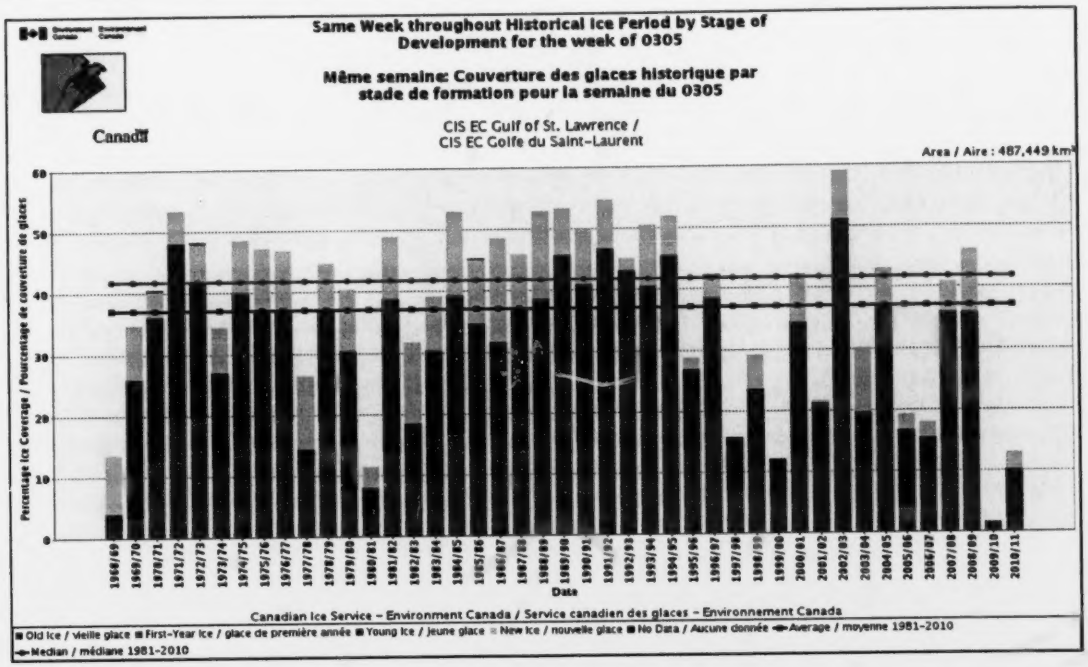


Figure 1. Historical area used by whelping harp seals in the northwest Atlantic indicating place names referred to in the text.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Même semaine: Couverture des glaces historique par stade de formation pour la semaine du 0305
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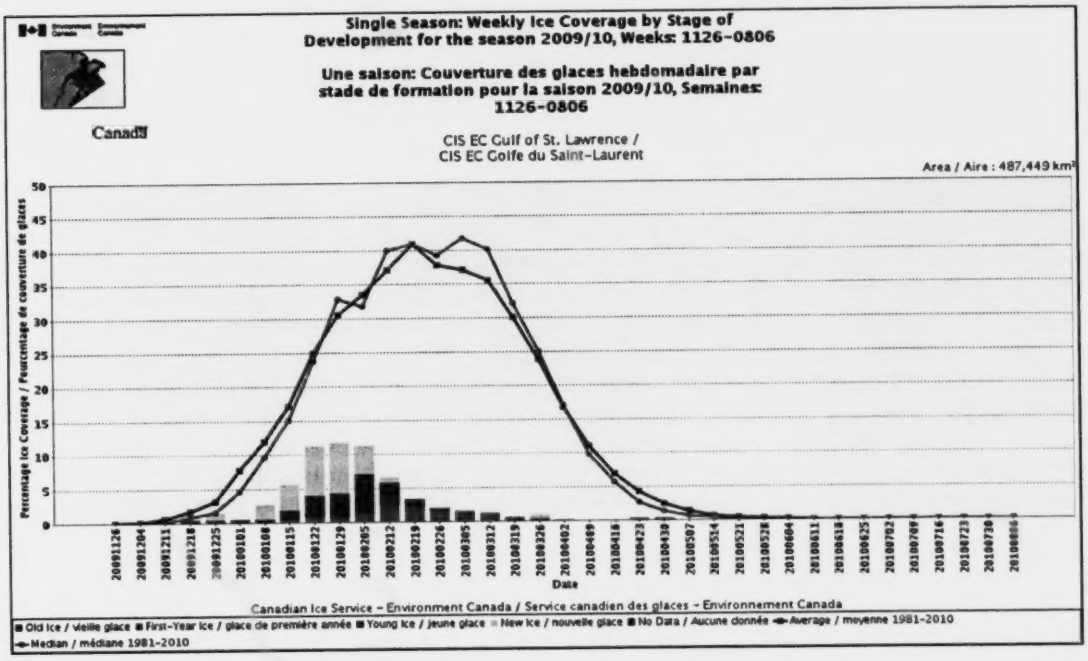
Area / Aire : 487,449 km²
Percentage Ice Coverage / Pourcentage de couverture de glaces
Date
Canadian Ice Service – Environment Canada / Service canadien des glaces – Environnement Canada
Old Ice / vieille glace
First-Year Ice / glace de première année
Young Ice / jeune glace
New Ice / nouvelle glace
No Data / Aucune donnée
Average / moyenne 1981-2010
Median / médiane 1981-2010

Figure 2. Ice accumulation in the Gulf of St. Lawrence on March 5, 1969–2011.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CIS EC Gulf of St. Lawrence / CIS EC Golfe du Saint-Laurent
Area / Aire : 487,449 km²
Percentage Ice Coverage / Pourcentage de couverture de glaces
Date
Canadian Ice Service – Environment Canada / Service canadien des glaces – Environnement Canada
Old Ice / vieille glace
First-Year Ice / glace de première année
Young Ice / jeune glace
New Ice / nouvelle glace
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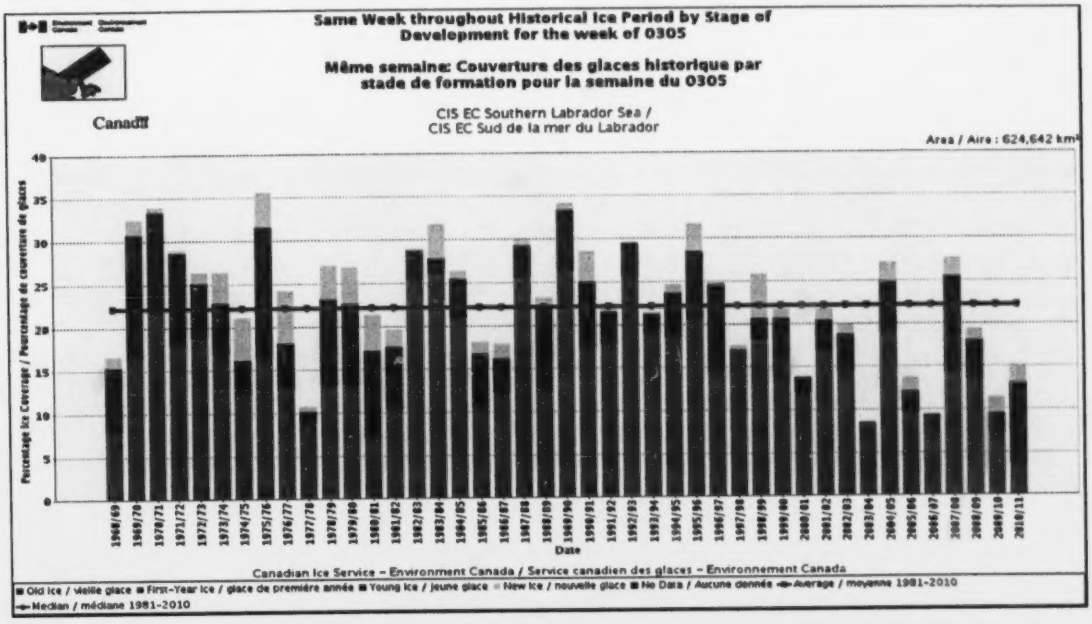
Average / moyenne 1981-2010
Median / médiane 1981-2010

Figure 3. Weekly ice cover in the Gulf of St. Lawrence during the winter of 2009-10.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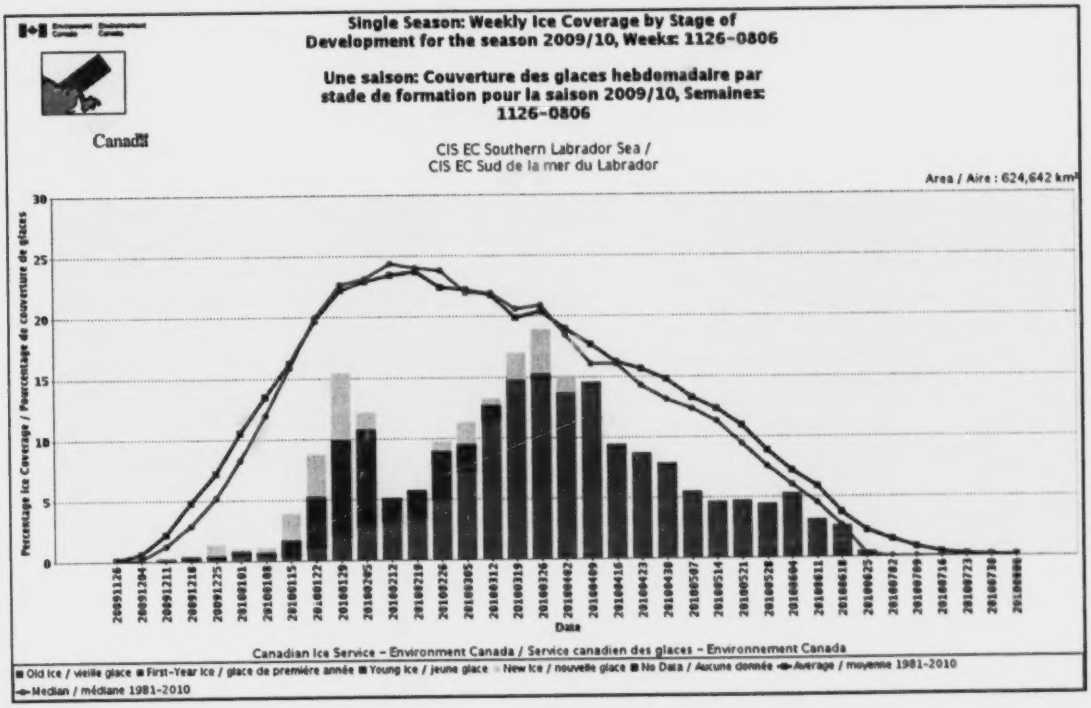
CIS EC Southern Labrador Sea / CIS EC Sud de la mer du Labrador
Area / Aire : 624,642 km²
Percentage Ice Coverage / Pourcentage de couverture de glaces
Date
Canadian Ice Service – Environment Canada / Service canadien des glaces – Environnement Canada
Old Ice / vieille glace
First-Year Ice / glace de première année
Young Ice / jeune glace
New Ice / nouvelle glace
No Data / Aucune donnée
Average / moyenne 1981-2010
Median / médiane 1981-2010

Figure 4. Ice accumulation in the southern Labrador Sea ('Front) on March 5, 1969–2011.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Area / Aire : 624,642 km²
Percentage Ice Coverage / Pourcentage de couverture de glaces
Date
Canadian Ice Service – Environment Canada / Service canadien des glaces – Environnement Canada
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First-Year Ice / glace de première année
Young Ice / jeune glace
New Ice / nouvelle glace
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Average / moyenne 1981-2010
Median / médiane 1981-2010

Figure 5. Weekly ice cover in the southern Labrador Sea during the winter of 2009-10.

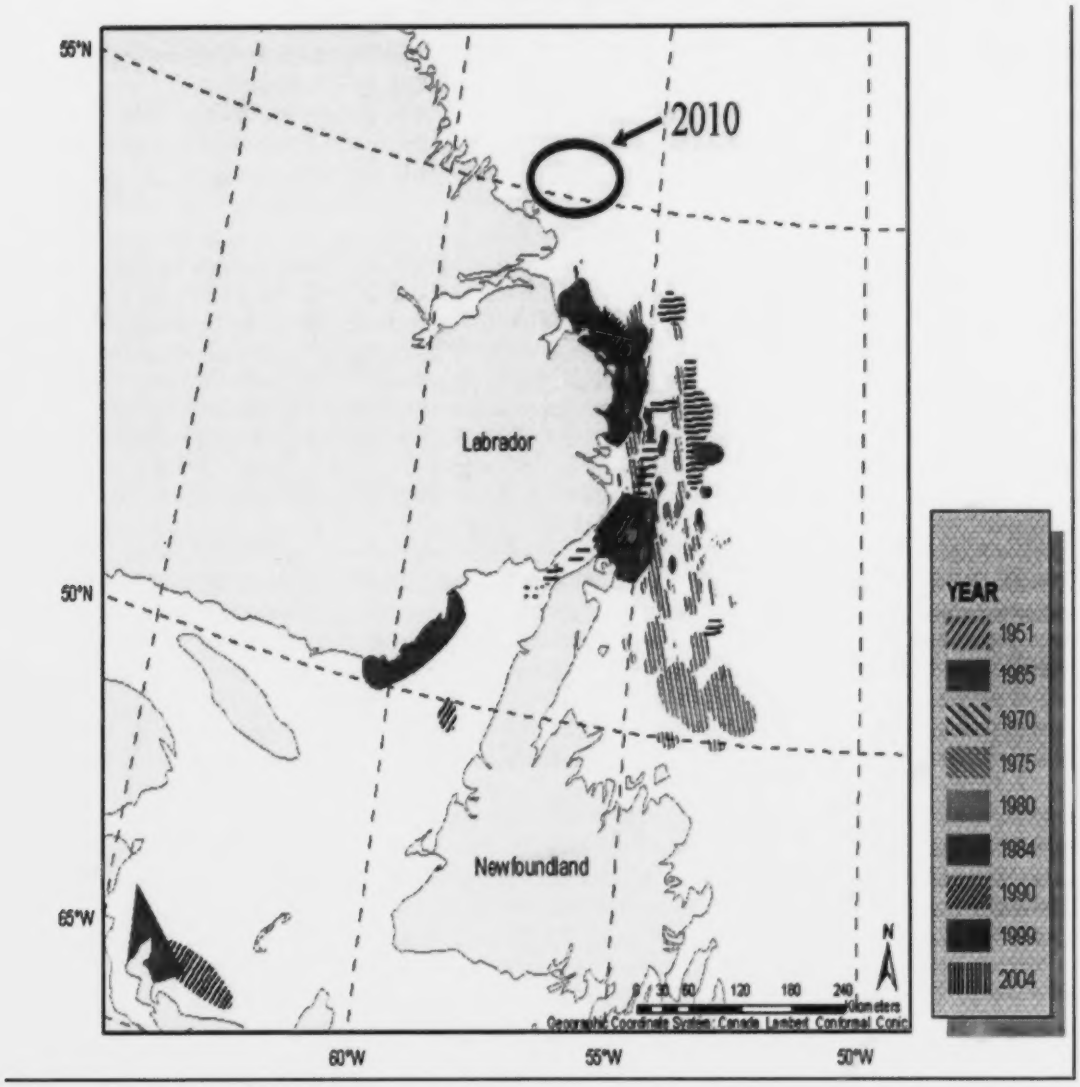
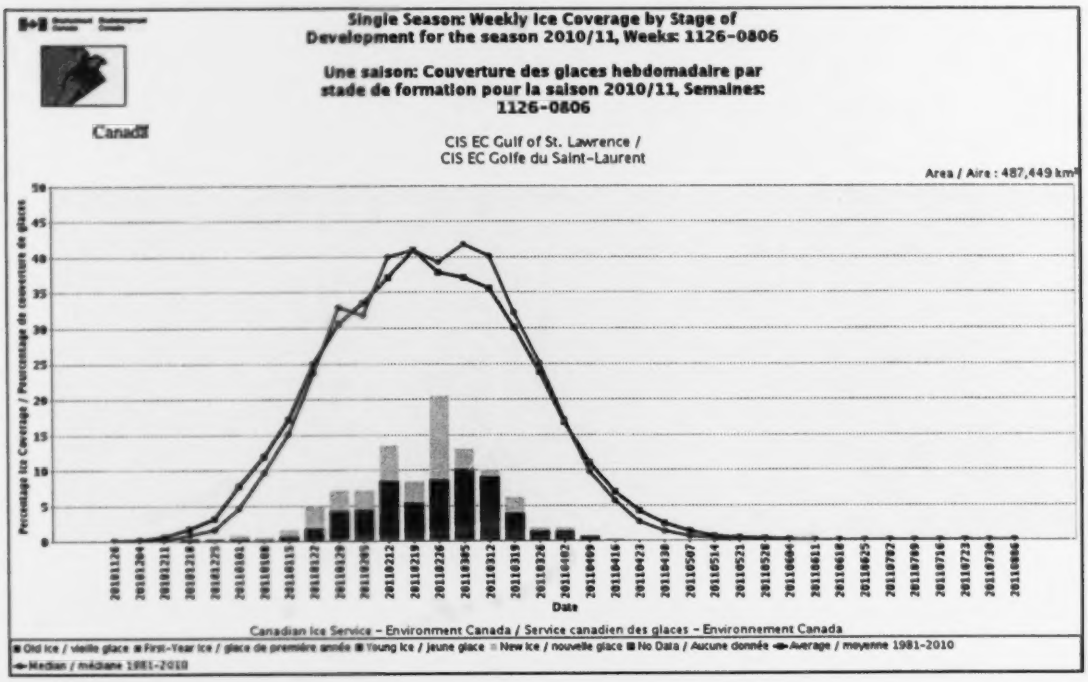


Figure 6. Locations of whelping harp seal concentrations, particularly at the Front, indicating the unusual location of whelping seals in 2010.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CIS EC Gulf of St. Lawrence / CIS EC Golfe du Saint-Laurent
Area / Aire : 487,449 km²
Percentage Ice Coverage / Pourcentage de couverture de glace
Date
Canadian Ice Service – Environment Canada / Service canadien des glaces – Environnement Canada
Old Ice / vieille glace
First-Year Ice / glace de première année
Young Ice / jeune glace
New Ice / nouvelle glace
No Data / Aucune donnée
Average / moyenne 1981-2010
Median / médiane 1981-2010

Figure 7. Weekly ice cover in the Gulf of St. Lawrence during the winter of 2010-11.

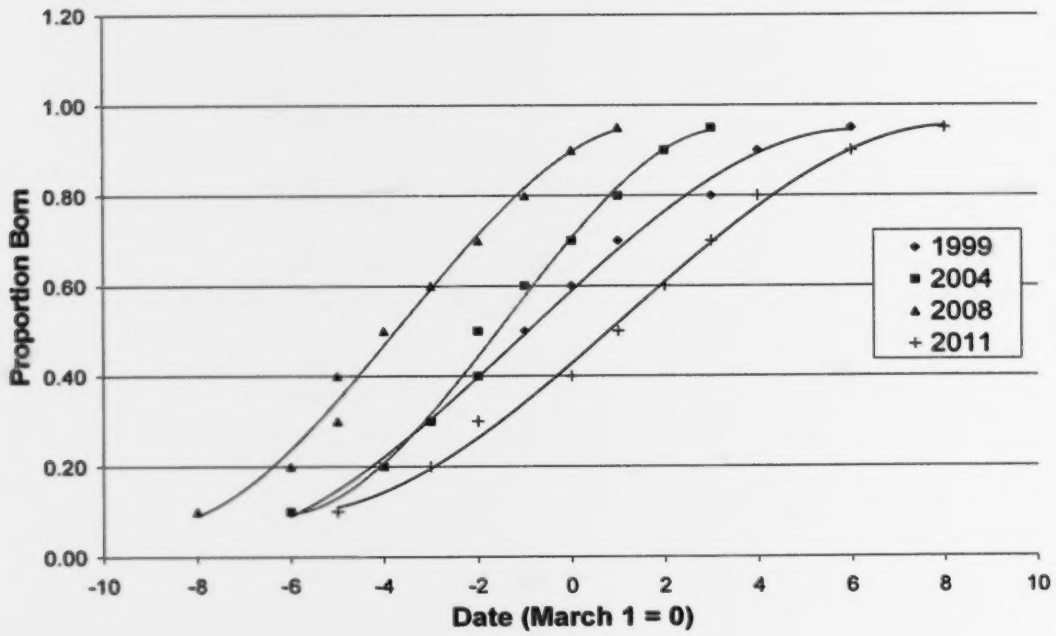

Figure 8. Timing of birth in the southern Gulf of St. Lawrence

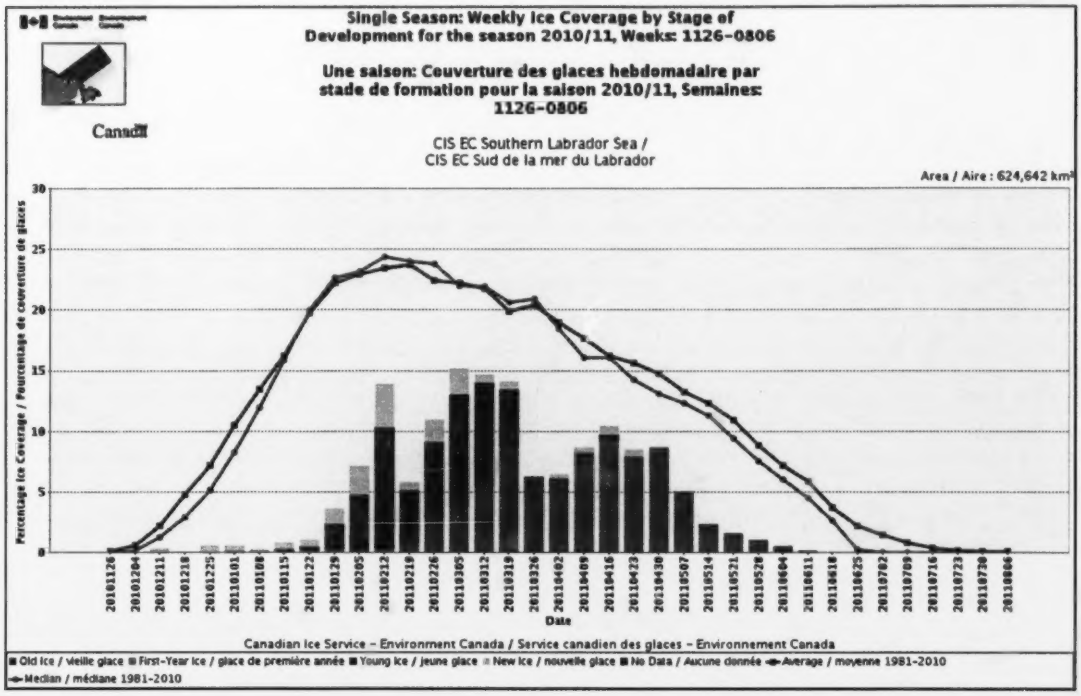
Single Season: Weekly Ice Coverage by Stage of Development for the season 2010/11, Weeks: 1126-0806
Une saison: Couverture des glaces hebdomadaire par stade de formation pour la saison 2010/11, Semaines: 1126-0806
CIS EC Southern Labrador Sea / CIS EC Sud de la mer du Labrador
Area / Aire : 624,642 km²
Percentage Ice Coverage / Pourcentage de couverture de glaces
Date
Canadian Ice Service - Environment Canada / Service canadien des glaces - Environnement Canada
Old Ice / vieille glace
First-Year Ice / glace de première année
Young Ice / jeune glace
New Ice / nouvelle glace
No Data / Aucune donnée
Average / moyenne 1981-2010
Median / médiane 1981-2010

Figure 9. Weekly ice cover in the southern Labrador Sea during the winter of 2010-11.